Concreting a Railroad

Monolithic Construction Being Freely Substituted for Wood and Iron

By R. P. Crawford

THE important role that concrete can be made to play in the maintenance of a railway right of way is being demonstrated by the Burlington railroad. Not only is that road making heavy use of reinforced concrete construction but it is also demonstrating how the work can be done efficiently and, most of all, economically. The plan embraces important steps looking forward to a rapid extension in the uses of concrete by American railroads as well as a standardization of product. The concrete gang along the right of way has been done away with to a large extent and the major part of the work for the entire system has been concentrated at plants maintained at Galesburg, Ill., Hannibal, Mo., and Havelock, Neb.

One of the problems that confronts the engineering department of every railroad is the construction and installation of bridges and other improvements along the right of way. Especially was it true that in the case of concrete projects practically all of the work had to be done on the spot. Under the new plan a large part of the work is done at one of the factories and a bridge can be shipped out practically complete, only the construction incidental to its installation being done along the right of way. In other words the job comes to the factory instead of the factory going to the job. Heavy savings are being effected by standardizing the work and a bridge erected under the new system costs substantially less than it would have a number of years ago, despite the advances in price of material.

Bridge decks and bridge slabs in standard sizes as well as piling to go with them, watering troughs for stock yards along the way, concrete fence posts and even curbing for the depot platforms are being turned out. When one considers that a reinforced concrete fence post can be manufactured for about twenty-two cents, or practically the same as a wooden post, the efficiency involved in the plan is apparent. A maximum force of twelve men in the factory at Havelock can in a year's time turn out, among other things, about 50,000 fence posts, 300 bridge slabs and 10,000 feet of platform curbing, not to mention enough watering troughs to meet all the railroad's stockyard requirements west of the Missouri River. And it must be remembered that most of the work can be done only during the warm season of the year.

Reinforced concrete slabs and piling for the small bridges are kept on hand in standard sizes and can be supplied to any point along the line on short notice. The slabs which form the bridge floors come in 14-, 16- and 20-foot lengths. In reality they are huge blocks of reinforced concrete. Each unit is 7 feet wide, and two of them are placed side by side to attain the 14-foot width of the standard single-track bridge. Each slab has a 6-inch parapet on one side, insuring a parapet on each side of the bridge. Ties are laid on the series of concrete slabs and the rails on top of these. The whole is filled in with gravel, giving the bridge the appearance of being part of the regular roadbed. The ballast on the bridge makes the track much easier riding and to the uninitiated the fact that a bridge is being crossed is not noticeable without a look out of the car window. Here another innovation comes into effect. Whereas, in the past the bridges have been maintained by special bridge men, now the regular track men are made responsible for their condition. The piling for the bridges is manufactured in standard lengths of from 14 to 30 feet, and practically an entire bridge is shipped out ready to be installed.

Besides the slabs for the small bridges, concrete decks are also manufactured for the flooring of steel bridges. These are 5x14 feet in size, each slab extending clear across a single track bridge. Ties are laid on the slabs and filled in with ballast the same as in the case of the smaller bridges. Naturally there is a much smaller demand for this sort of slab, since there are comparatively few long bridges.

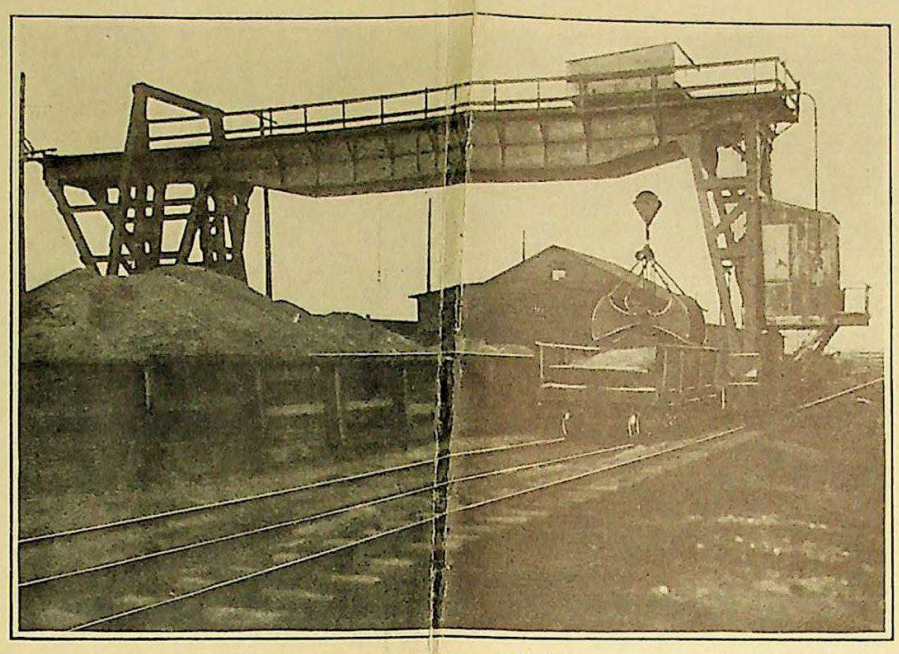
While most railroads are now adopting the concrete bridge, a good share of them maintain the concrete gang along the line as a solution of the problem. This means that a much longer time is taken for the work and with several such jobs going on a much larger force of men is required for concrete work. Under the new system there still remains considerable work to be done in installing the bridge and in some cases the old plan of building a bridge on the spot has to be resorted to on account of peculiar conditions involved.

The concrete plant at Havelock occupies a space about five blocks long and 60 feet wide. One frame building is devoted to the manufacture of fence posts and another building to making concrete watering troughs. The heavier work, such as the manufacture of reinforced concrete slabs, is done out of doors during the warm season. An overhead crane extends across the entire plant, running on a railway with one rail at each side of the concrete yard. In that way the loading upon cars of bridge slabs, some of which weigh twenty-six tons, is easily accomplished. The concrete mixer for the outdoor work is mounted upon a platform extending across the line of molds and running on rails at either side. In that way the mixer can easily be transported to any part of the yard where it is desired to work.

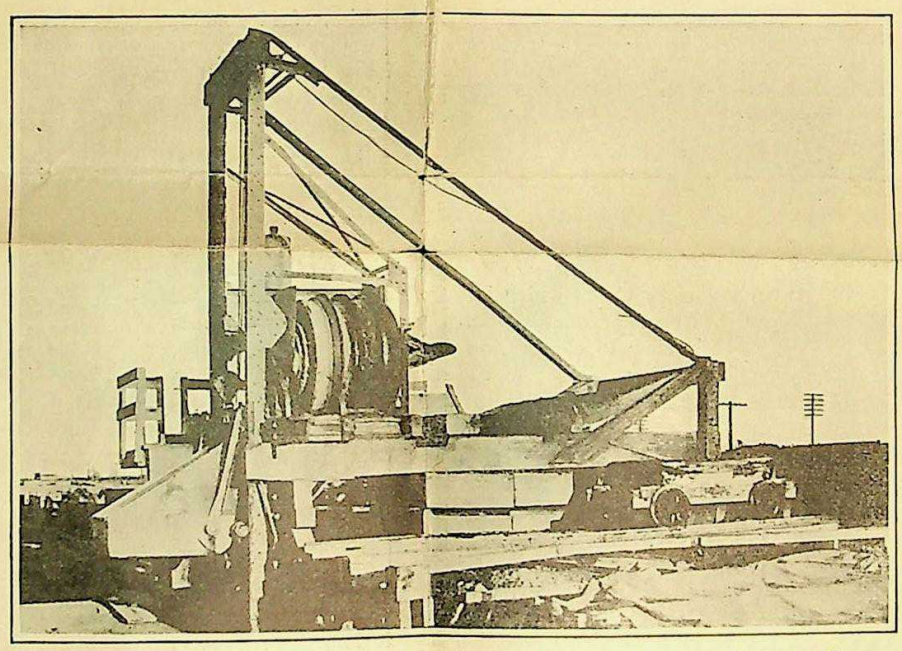
The building devoted to the manufacture of watering troughs of course has its own concrete mixer. A system of narrow gage tracks with little cars carrying the trough molds connects the building with the outside yard. When the manufacture of a trough has been completed it is run out of the building on one of the cars and deposited in the yard. In that way all the trouble of handling them by hand is practically done away with. The concrete trough is a marked improvement over the old wooden trough and affords sanitary drinking conditions for the stock being transported over the road.

Practically all of the concrete fence posts are made at the plant at Havelock. This part of the work is done in speedy fashion with a specially devised machine. The

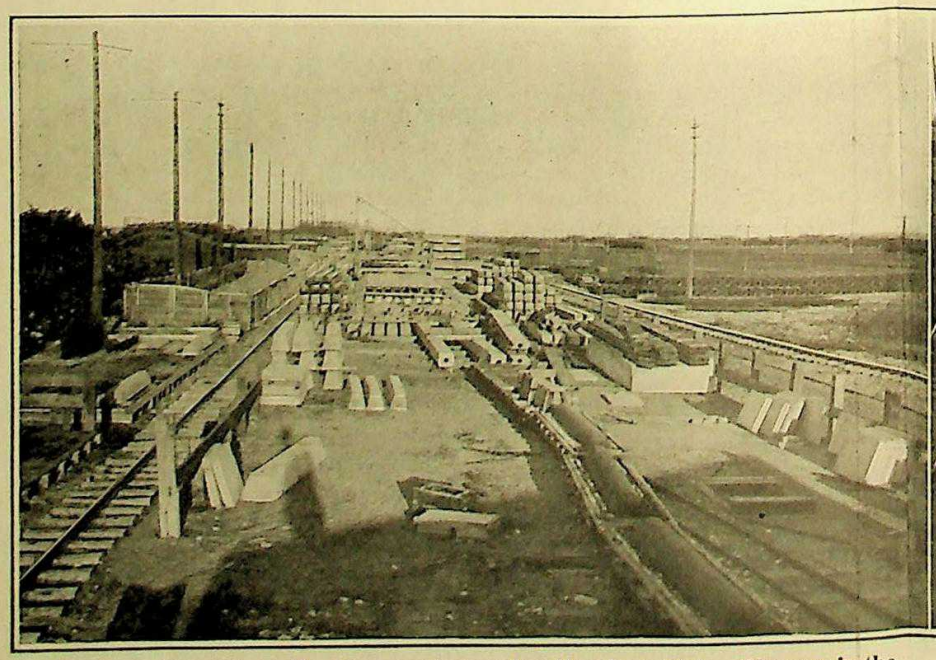
(*Concluded on page 267*)



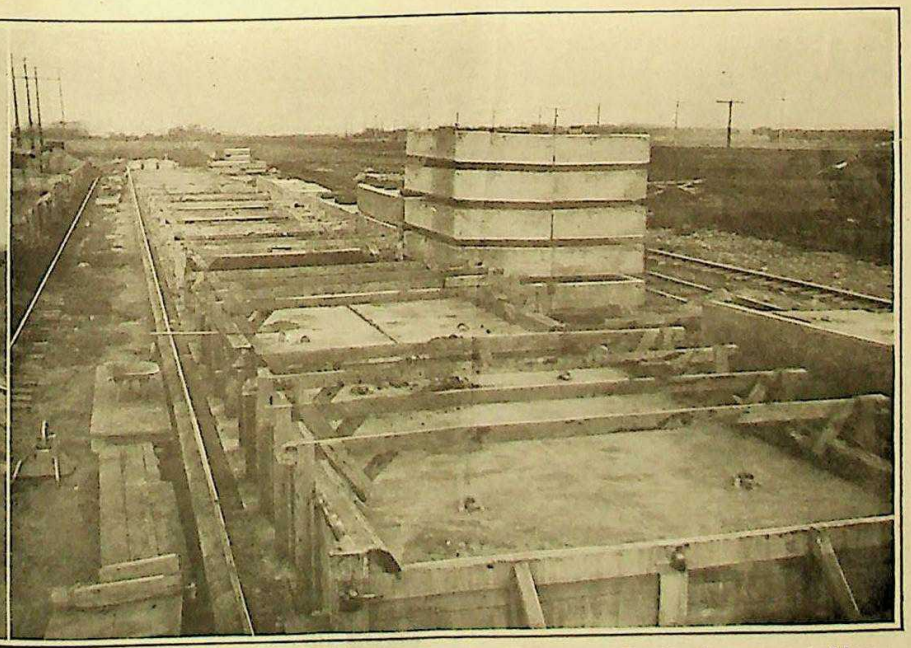
Traveling crane unloading sand in the concrete yard



The concrete mixer, mounted on rails for moving to any part of the yard



General view of the railroad concreting yard at Havelock, Neb. The cars in the foreground carry molds for concrete water-troughs



The corner of the yard where the huge slabs for the standardized concrete bridges are made. A pile of finished slabs is seen at the right

Astronomy

Martian Snow-caps and Sunspots.—Since the preliminary announcement that he had found an apparent relation between the sunspot period and the behavior of the polar caps of Mars, M. Antoniadi has published detailed observations which appear to establish this relation in a striking manner. Except in two years, 1862 and 1877, when local conditions on Mars may have disturbed the effects of solar radiation, he finds that whenever sunspots are large and numerous the melting of the Martian polar caps is rapid, and that whenever sunspots are small and few the melting of the caps takes place slowly. As Maunder has pointed out, the meteorology of Mars is much simpler than that of the earth. Hence a more direct response on the part of Martian "weather" to the variations in solar radiation of which greater or less spottedness is one of the indications.

The Nebula N. G. C. 2261.—A spectrogram of Hubble's variable nebula N. G. C. 2261, which has as its nucleus the variable star R Monocerotis, shows the nucleus and the nebula to have the same peculiar spectrum consisting of bright lines or bands—not those typical of gaseous nebulae—and a continuous spectrum. This observation suggests that the nebula shines by reflected light of the pulsating nucleus, and that the flow of the light-pulses over the nebula causes its variation and could give its distance. From the material now available it is difficult to give any trustworthy value for the apparent displacement. It may be as great as fifteen seconds of arc. Taking this value and the simplest case of displacement perpendicular to the line of sight, which would give a maximum value for the distance and would generally overstate it, the parallax would be about 0.00027 or the distance some 12,000-light years.

Barnard's "Runaway" Star, as we have generally called the star of remarkably great proper motion recently discovered in Ophiuchus—while other journals have referred to it under the rather meaningless name of "Barnard's proper-motion star"—is probably nearer to the solar system than any other fixed star whose parallax has been measured, with the exception of Alpha Centauri. The parallax observations at the Allegheny Observatory give a value of 0.5 second, while from micrometric measures made by Barnard, Russell obtains a value of 0.70 second. The parallax of Alpha Centauri is 0.76 second, corresponding to a distance of 4.3 light-years. According to determinations made by F. Gonnessiat, in France, from a comparison of photographs extending back to 1897, the new star is even nearer than Alpha Centauri. He finds its parallax to be approximately one second, representing a distance of only 3.26 light-years.

An Old Observation of Barnard's "Runaway" Star.—Dr. A. C. D. Crommelin has pointed out the fact that the star recently discovered by Prof. Barnard to have a proper motion of more than ten seconds per annum was almost certainly observed by Lamont at Munich in July, 1842. The star was one of those enumerated in Lamont's "zones," and its designation is, accordingly, Munich (1) 15040. Prof. Bauschinger revised Lamont's zones at Munich about 1886, and in seeking for this star he naturally did not find it, as it had moved more than 7 minutes of arc from its former place. According to the spectroscopic observations of Professors Adams, Campbell and Slipher this interesting star is approaching us at a speed of something like 100 kilometers per second, and this should bring about a gradual increase in its proper motion; assuming the parallax found by Schlesinger, the proper motion would increase about .05 second a century.

The Total Solar Eclipse of June 8, 1918.—An article on this forthcoming event, by Edison Pettit, of Washburn College Observatory, points out the fact that the eclipse will be a return of that of May 28, 1900, *i.e.*, the intervening interval is the ancient eclipse cycle, or Saros, of 18 years 11⅓ days. Accordingly, while the 1900 eclipse occurred about 8 A.M., that of 1918 will occur about 4 P. M. (on an average for the whole country). The duration of totality is about the same in the two eclipses; viz., a minute and a half. The 1918 eclipse will begin when the moon's shadow strikes the earth on the little island of Borodino, off the coast of Japan, at sunrise, June 9, 1918. It will then sweep eastward, and after a lapse of two hours and fifteen minutes, will arrive at the mouth of the Columbia River, Wash., June 8, at 2.25 P. M., Pacific time, when it will be going at a speed of thirty-three miles a minute. It will cross the Mississippi River at 5.37, Central time, and leave the coast of Florida at 6.42, Eastern time. The diagonal journey across the United States will take forty-seven minutes. Mr. Pettit suggests that in case one of the eclipse parties in the western states should discover anything of novel interest, such as an apparent intra-mercurial planet, the fact could be telegraphed to other parties along the track of the eclipse in ample time to have the discovery checked by other observations. Some eighty-five towns, all accessible by rail, lie along the path of totality.

Science

Testing Tuning Forks is a new line of work, which the versatile United States Bureau of Standards has taken up. A tuning fork for use in ordnance tests has recently been standardized for the War Department, and equipment has been secured for carrying on such work regularly.

Specifications for Lightning Conductors.—Last year the Bureau of Standards issued a valuable bulletin on lightning protection, constituting a digest of the latest information on this subject. The bureau has since been conferring with the manufacturers of lightning-protection material and others and is preparing to issue specifications for protection systems, for the use of architects and builders.

The "Black Siberian Hare."—The Department of Agriculture has issued a warning on the subject of this animal, which certain dealers are trying to palm off on the guileless public. The situation recalls that of the "miracle wheats," concerning which the department recently enlightened the country. The "black Siberian hare" is advertised to produce a pelt of high market value. The fact is that, although more skins of hares or rabbits are collected and sold than of all other fur-bearing animals combined, no variety is worth raising for its fur alone. Moreover, Siberia does not produce hares, and the alleged new variety is merely a black strain of the "Flemish giant" breed of European hare.

Woods Called "Mahogany."—A bulletin just published by the Department of Agriculture on the subject of mahogany records, among other interesting facts, the bewildering ambiguity of the term "mahogany." True mahogany is produced only by two closely related species of tree, *Swietenia mahagoni Jacq.* and *Swietenia macrophylla* King, both natives of tropical America. The name "mahogany," with or without some qualifying word such as "Indian," "Madeira," "African," "Philippine," etc., is, however, applied to cabinet woods grown in a great many parts of the world. These so-called mahoganies belong to 67 distinct species, of 41 genera, and they are scattered through 18 families of the vegetable kingdom. Of some of the West African species the botanical status is unknown. To add to the confusion, true mahogany has many names and several more or less distinct varieties are recognized commercially.

The National Gas-Safety Code.—The last annual report of the Bureau of Standards tells of the progress that has been made in the preparation of a national Gas-Safety Code, which is intended to cover all phases of the production, distribution and utilization of gases with a view to eliminating dangers to life and health, and fire hazards. The code will consist of 10 parts, dealing with (1) manufacture, (2) distribution, (3) appliance design, (4) gas-fitting, (5) appliance installation, (6) natural-gas wells and field stations, (7) acetylene, (8) bottled-gas systems, (9) blast-furnace, producer and gasoline gas (10) utilization and information for users. The American Gas Institute has appointed 12 committees to collect information on different topics and in different sections of the country; while the National Commercial Gas Association, the Natural Gas Association of America, the National Fire Protection Association, the American Institute of Architects, the National Safety Council, and the National Association of Master Plumbers are all coöperating in the preparation of the code. Part 4, on gas-fitting, is in an advanced stage of preparation and will be published first, as the need for this part is most pressing.

Electrolysis in Pipes and Cables.—The damage done annually to underground pipes, cables and other metal structures in this country by electrolysis amounts to many millions of dollars. There are very few water, gas or lead cable systems that are not more or less subject at some points to electrolytic damage from stray currents. Moreover, the loss does not consist merely in the shortening of the life of such structures; electrolytic damage is one of the causes of the leakage of water and gas from distribution systems. The failure of such systems on account of electrolytic action may also involve various dangers to the life and health of human beings. According to the Bureau of Standards more than twenty-five separate and distinct methods of dealing with the electrolysis problem have been proposed and experimented with from time to time. Some of these methods are useless, or even harmful. The Bureau of Standards has been studying the subject of electrolysis mitigation for the past six years, and has aided in installing complete mitigative systems in several cities. The bureau makes somewhat detailed tests in each of these places about once a year to make sure that the protective systems are being properly maintained. An extended series of experiments has recently been undertaken in the city of Springfield, Mass., with the so-called three-wire system of electric railway operation; a system which offers considerable promise for the mitigation of electrolysis troubles under certain conditions frequently met with in cities.

Electricity

Flaming Arc Lamps for Illuminating Aviation Fields, instead of petrol flares for this purpose, are advocated by Mr. Charles Bright, in the Final Report of the Committee on the Administration and Command of the Royal Flying Corps. It is pointed out that the flaming arc lamps are more readily controlled and give the best light for penetration of fog.

Portable Electric Winches.—Much time and labor are saved in a great variety of tasks by the use of electric winches at the Bush Terminal, in Brooklyn, N. Y. These winches are of the portable type and can be moved about as necessity dictates. Current can be tapped from the nearest feeder, a great number of taps being always within convenient reach in any part of the Bush Terminal development.

Lehigh Valley May Electrify Part of Main Road.—The Lehigh Valley Railroad is investigating the feasibility of electric operation of its main line, from Jersey City to Wilkes-Barre, about 176 miles, and the Mahanoy and Hazleton division, from Penn Haven Junction to Mount Carmel, about fifty-two miles, according to the *Electrical World*. It is planned to employ the generating plants of the Lehigh Coal & Navigation Company at Harwood and Hauto, with the installation of new power units and necessary transmission system. The improvement is estimated to cost about $11,000,000.

Largest Motor Yet Built.—What is said to be the largest electric motor yet built has recently been completed by a leading American electrical manufacturer, for use in driving a two-high 35-inch reversing blooming mill, which reverses for every pass; that is, every time metal goes through the rolls. Reversals can be made from full speed to full speed in about two seconds, and in regular work nineteen or twenty passes are made in two minutes. The motor has a rating of 15,000, and complete it weighs more than 250 tons. It is 20 feet high, and the shaft is over 2 feet in diameter.

Early Electro-Mechanical Interlocking on Railroads.—In the *Railway Gazette* there has been some discussion regarding the date at which electrically-operated shunting signals were first introduced on railroads. It has been stated that the first occasion on which such a system was used in the United States was at Gap, on the Pennsylvania Railroad, on December 30th, 1909. On the other hand, electrically-operated shunting signals were installed at Victoria Station (London) in a form similar in principle to that now generally used on railroads, as early as 1880. It appears, therefore, that in this matter the London, Chatham & Dover (now South Eastern & Chatham) Railway forestalled the United States by 30 years.

The Use of Steel in Transmission Lines.—In a recent paper read at a joint meeting of the American Institute of Electrical Engineers and the Association of Iron and Steel Engineers, Mr. H. B. Dwight emphasizes the utility of steel cables for transmission purposes on branch lines, especially in cases where the size of copper strictly required to meet the load would be too small for use in practice. For alternating currents the resistance of a steel cable is considerably greater than for direct current, owing to skin effect. In copper or aluminum conductors the latter is negligible, increasing the resistance by at most 1 or 2 per cent, but at high frequencies the apparent resistance of steel conductors may be increased by 100 per cent or more. The losses may be kept within moderate limits by using fine strands to act as laminations, and by winding the spirals of alternate layers of wire in reverse directions.

American Electric Cars in Barcelona.—The electric railroad running from Barcelona to Sarria, a distance of three miles, has recently been extended as far as Las Planas, about 3½ miles farther. The new section starts from the station of Sarria, passes through a tunnel 653 feet in length, follows the mountain stream Pomaret, the course of which has been partially diverted, passes through a second tunnel 1,194 feet long, and farther on through a third tunnel 564 feet. At the exit of this tunnel an underground station has been built, beyond which the line passes through a fourth tunnel piercing the mountain of Vallvidrera. This tunnel, 1 mile, 175 feet long, is the most important work on the extension on account of the difficulties encountered in its construction. The rolling stock of this Spanish line has been especially built to conform with the requirements of the local service and comprises electric motor cars and trailers. The cars were built by a Philadelphia company and are mounted on trucks provided with four motors of 125 horse-power. The passenger cars are closed and are 56 feet long, designed for single and double-end operation. The cars have a maximum speed of about thirty-seven miles an hour. Freight cars consisting of a platform mounted on two trucks with two compartments for the motorman are also in use both for transporting general merchandise as well as the company's construction material in continuing the line, which in due course will be extended to the interior towns of Tarrasa and Sabadell, and eventually farther.